



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No.: 3473
Tsuyoshi YUKI et al.	Group Art Unit: 1714
Application No.: 10/632,108	Examiner: Shruti S. COSTA
Filed: August 1, 2003	Attorney Docket No.: 103176-00003

For: VISCOSITY INDEX IMPROVER AND LUBE OIL CONTAINING  
THE SAME

DECLARATION

HONORABLE COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

SIR:

Now come TSUYOSHI YUKI who deposes and says that:

1. I am one of the inventors of the invention entitled "VISCOSITY INDEX IMPROVER AND LUBE OIL CONTAINING THE SAME" as claimed in United States Patent Application Serial Number 10/632,108 filed August 1, 2003.
2. I graduated from Kansai University in March, 1991.  
I then studied at the graduate school of the University and received a Masters Degree in connection with the study of Organic synthesis using organic metal catalyst in March, 1993.  
I have been working for Sanyo Chemical Industries, Ltd., in Kyoto, Japan, as a research chemist since April, 1993, particularly in the field of polymer chemistry.
3. I have measured wear resistance of lube oil compositions containing of the copolymers comprising units of less than 5wt% or 5wt% or more of a monomer having hydroxyl group or carboxyl

group.

4. It is my opinion that the copolymers comprising units of 5wt% or more of the monomer having hydroxyl group or carboxyl group are superior to the copolymer comprising units of less than 5wt% of the monomer, with respect to wear resistance of lube oil compositions.

In support of this opinion, the following experiments were performed.

(1) Production of Copolymers ① to ⑫

( ① - ④ are Comparative Copolymers comprising units of 4wt% of the monomer having hydroxyl group or carboxyl group, and ⑤ - ⑫ are Copolymers of present invention comprising units of 6wt% or 25wt% of the monomer having hydroxyl group or carboxyl group)

Into a reaction vessel equipped with a stirrer, a heating and cooling device, a thermometer, a dropping funnel and a nitrogen inlet tube, 25pbw of isopropylalcohol as solvent for polymerization was charged and heated to 85 °C within an atmosphere of nitrogen. While maintaining the temperature within 70-85 °C, a mixture of 1.5pbw of Dodecylmercaptan, 0.5pbw of 2,2'-azobis-(2,4-dimethylvaleronitrile)(ADVN), 6pbw of isopropylalcohol and monomers as written in Table 1, were added thereto dropwise from the dropping funnel over 2 hours in the absence of air. The reaction mixture was held for 2 hours at 85 °C to complete polymerization, followed by distilling off isopropylalcohol under reduced pressure for 3 hours at 85-120 °C to obtain Copolymers ① to ⑫.

(2) Measurements of the Wear Resistance of Lube Oil Composition containing Copolymer ① to ⑫ was carried out by the following manners.

(2-1) Preparation of Viscosity Index improver Concentrates and

#### Lube Oil Compositions

Into 35 pbw of a mineral oil (solvent-refined oil having a Kinematic Viscosity of  $2.3 \text{ mm}^2/\text{s}$  at  $100^\circ\text{C}$ ), was dissolved 65 pbw of each of Polymers ① to ⑫ to prepare Concentrates ①-C to ⑫-C, respectively.

Into a stainless steel vessel equipped with a stirrer, was charged a base oil (having a Kinematic Viscosity of  $4.3 \text{ mm}^2/\text{s}$  at  $100^\circ\text{C}$  and a Viscosity Index of 121) and each of Concentrates ①-C to ⑫-C, in such an amount providing a lube oil composition of a Kinematic Viscosity in the range of  $14.3 \pm 0.2 \text{ mm}^2/\text{s}$  at  $100^\circ\text{C}$  to prepare 100pbw of lube oil compositions. Resulting amount of each Concentrates were 15 pbw in each lube oil compositions.

(2-2) Measurement of the Wear Resistance of Lube Oil Composition.

Wear Resistance was evaluated by wear mark diameters of balls measured by ball-on-disk equipment 'Optimol SRV testing machine' at the following test conditions.

Wear mark diameter : average value of the vertical and  
horizontal diameter of a wear mark of  
a ball

Equipment: Optimol SRV testing machine(Nihon Parkerizing  
Co., Ltd.)

Ball: 10mm in diameter

Disk: 24mm in diameter x 7.9mm in thickness

Load: 200N

Stroke width: 2mm

Frequency: 50Hz

Examination time: 15min.

Results were shown in Table 1.

Table 1.

	Comparative Example				Example							
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫
(a) D-TM	50	-	25	50	50	-	25	50	50	-	25	50
O-DM	-	50	25	-	-	50	25	-	-	50	25	-
(b) DDM	10	10	10	10	10	10	10	10	5	5	5	5
TDM	36	36	36	36	34	34	34	34	20	20	20	20
(c) HEMA	4	4	4	-	6	6	6	-	25	25	25	-
MAA	-	-	-	4	-	-	-	6	-	-	-	25
Diameter of wear (mm)	0.65	0.69	0.72	0.75	0.35	0.37	0.41	0.46	0.26	0.28	0.21	0.30

D-TM : 2-decyltetradecyl methacrylate (C=24)

O-DM : 2-octyldodecyl methacrylate (C=20)

DDM : 6,6-dimethyl methacrylate (C=12)

TDM : tetradecyl methacrylate (C=14)

HEMA: hydroxyethyl methacrylate (hydroxyl group containing monomer)

MAA : methacrylic acid (carboxyl group containing monomer)

5. I declare further that all statements made herein of my own knowledge are true and that all statements based on information and belief are believed to be true; and, further, that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Further, deponents sayeth not.

Date: 2006. 12. 6

Tsuyoshi Yuki

Tsuyoshi YUKI